

COVER MISSING

The following paper was read before the Columbian Institute, on the 9th of December, 1826, by Col. ROBERT AU.

OBSERVATIONS ON THE SURVEY OF THE SEA COAST OF THE UNITED STATES.

This matter, so important to the Government of the United States, as well as to the interests of the nation, in its various relations and results, may be justly entitled to the attention of the community, and more particularly, to the notice of the national institute here, as being intimately connected with the investigation and advancement of science; and, if an object of such acknowledged importance be passed by, at the seat of Government, and within the sphere of this Scientific Institution, erroneous opinions might, and probably would, attach to the omission, and its utility, by other societies of a similar character, doubted, because in no other way than under the immediate patronage of the General Government, can any such project be successfully undertaken. For these, and other reasons that might be adduced, the subject is now brought before the Institute, in preference to any other, where a mere abstract proposition of speculative science might be substituted, and the impression of its importance will, it is hoped, be a sufficient apology. In doing this, it is not intended to enter into arguments, or minute details, which would require more mature consideration than can be now devoted to it, but merely give an outline history of what has been attempted, with such general observations as may appear to arise from it, the correctness of which is with great deference submitted to the Institute.

The survey of the sea-coast of the United States was brought before Congress, by the President, (Mr. Jefferson,) during the session of 1807, and an appropriation of \$50,000 for this object made on the 10th of February, of that year. The act authorized and requested the President to cause a survey to be taken of the whole of the coast of the United States, with the adjacent shoals and soundings, employing proper persons in accomplishing the purposes described in it.

Agreeably to this provision, on the 25th of March

following, the Secretary of the Treasury, (Mr. Gallatin,) addressed a circular letter to several gentlemen of science, requesting their opinions individually respecting the plan to be adopted. This letter explains the objects of attention in these words:

"The President of the United States being authorized by an act of the last session to cause the whole of the coast of the United States, together with the adjacent shoals, and soundings, to be surveyed, it is his intention that the work should be executed with as much correctness as can be obtained within a reasonable time," requesting the suggesting of the outlines of such a plan, as may, in their opinion, unite correctness and practicability. Mr. Gallatin then defines three distinct parts of which the work should consist, viz:—

"1. The ascertainment, by a series of astronomical observations, of the position of a few remarkable points on the coast, and some of the light houses placed on the principal capes, or at the entrance of the principal harbors, appear to be the most eligible places for that purpose, as being objects particularly interesting to navigators, visible at a great distance, and generally erected on spots on which similar buildings will be continued so long as navigation exists.

"2. A trigonometrical survey of the coast between those points of which the positions shall have been astronomically ascertained; in the execution of which survey, the position of every distinguishable permanent object should be carefully designated; and temporary beacons be erected at proper distances on those parts of the coast on which such objects are rarely to be found.

"3. A nautical survey of the shoals and soundings of the coast, of which the trigometrical survey of the coast itself, and the ascertained position of the light houses, and other distinguishable objects, would be the bases; and which would therefore depend but little on any astronomical observations made on board the vessels employed on that part of the work."

These three propositions were submitted for the consideration of those gentlemen to whom this circular letter was addressed, and a question respecting the difficulties attendant upon the nautical survey is also made, viz: "Can a nautical survey be made with one vessel alone? Can angles be taken with sufficient

correctness from on board a vessel, so as to ascertain its position in relation, to three visible objects on shore, or is it necessary that the vessel's position at the time of taking any particular sounding should be ascertained by observers on shore, &c."

This circular was addressed to Mr. J. R. Hassler, among others, who was then Professor of Mathematics at the College at Schenectady in the State of New-York, a gentleman well qualified for the task, and it was replied to by him on the 2d of April following: both of which are to be found in the 2d volume of the Transactions of the Philosophical Society of Philadelphia, published in 1825.

In this reply of Mr. Hassler, he enters into a minute description of two methods, each of which may be pursued in the attainment of the object.

The first by a complete triangulation survey of the whole coast, including the determination of the latitude, longitude, and azimuths of the principal places, such as light houses, capes, &c. The sides of the triangles to be from about 60,000 to 100,000 feet in extent, resting on two or more bases, measured with the greatest possible accuracy; together, also, with a survey of the harbors, shoals, soundings, &c. of the coast, and filling up the details of all included within it.

The second method omits the large triangulation, but retains the design of fixing the prominent points and features of the shore, by the same mode of determining by astronomical observation, their latitude and longitude, and correcting the differences in time, by the comparison of good chronometers. the details to be filled up by smaller instruments, as circumstances might direct.

Together with this description, a plan was also submitted for putting the survey into operation, in which a prominent feature is the establishment of two observatories, which were to form the fixed points, to which the survey, and particularly the nautical part of it, should be referred, their situations were recommended to be in the State of Maine, and in lower Louisiana, "as from them nearly every celestial phenomenon observable from the tropic to the arctic circle, and within about 200 degrees of difference of longitude could be observed at one or other of them, at the same time, affording the means of comparison

with each other, and supersede the necessity of referring to Europe for corresponding observations." Still, Mr. Hassler observes, "that various considerations might occasion, and favor the desire of placing one of these observatories in the City of Washington, as observatories are placed in the principal capitals of Europe, as a national object, a scientific ornament, and a means of nourishing an interest for science in general. This observatory would then be the proper place for the deposit of the standards of Weights and Measures, which makes a part of the collection of Instruments."

This plan also embraces all the details of the intended survey, the persons necessary as assistants, and their respective duties. The principal survey proposed by it, was to form a chain of trianglies, with sides of about thirty miles in length along the whole extent of the coast, determining the azimuths of their sides, and the latitude and longitude of their angular points; within these, a series of *triangles of about 10 miles in their sides*, in order to furnish an ample number of determined points to which the survey may be referred in all its details.

From this epitome it is evident that the first method, by large triangulation, was contemplated, and preparations for it made.

An objection to this method might arise, from an imperfect knowledge of the localities of the country, which he acknowledges, and which would lead to uncertainty in the adaptation of fixed principles of action (how perfect soever in other respects) to its peculiarities. Difficulties would doubtless be interposed to the forming of a chain of triangles of 30 miles in their sides, by the intervention of canebrakes, &c. to the South, and at other places by the extensive and dense forests, with which the low grounds are sometimes covered; other impediments would probably be presented in certain parts of the country, arising from its present uncultivated state, and occasion a tardiness in obtaining the necessary correctness, and an increase of expense in the execution wholly inadmissible; Mr. Gallatin may have had this in view when, in his circular letter, he observes, that the work should be executed with as "much correctness as can be obtained within a reasonable time," knowing that Congress were to be the judges of the rea-

sonableness of the time, as well as of the attendant expenses, and that an excess in either would endanger the success of the whole project.

Whether any, or what systems were recommended by the other gentlemen to whom the circular was addressed, is unknown; but this of Mr. Hassler being adopted, the first step towards the execution of the law was to procure the necessary instruments from England: and he was employed, under the authority of the President to proceed to London, and there to superintend their construction.

Mr. Hassler sailed for England on the 30th August, 1811, to perform the duties assigned to him, under instructions dated on the 23d of that month, from whence he returned to the United States in October, 1815, bringing with him the instruments and books, &c. necessary to the survey, agreeably to a list which had been prepared, and which were approved by Dr. Patterson, then Director of the Mint, in whose care they were then placed.

The cost of these instruments and books, as appears by a settlement of the account in the Auditor's office in the Treasury, July 17, 1816, was as below:

Cost of Instruments and books, procured	
by Mr. Hassler for the survey of the	
coast of the United States in London	
and Paris, including packing, &c.	
	\$17,167 61
Compensation and expenses of Mr. Hass-	
ler in procuring them,	
	20,382 37
<hr/>	
Total,	\$37,549 97

Soon after his arrival, Mr. Hassler commenced his operations by forming a base line on Staten Island, from which a number of triangles were taken, and reported; these also are recorded in the philosophical transactions, in the account there given of the survey, and the best results were anticipated from the well known abilities of that gentleman, but circumstances unforeseen at the commencement of the undertaking had occurred unfavorable to the present prosecution of it; for, in the mean time, a war had commenced and terminated between the United States and Great Britain.

Emerging from a contest which had called forth all the energies of the nation, the expenses of which were undefined, a disinclination to the promotion of

science, or to improvements of this kind, very naturally prevailed, and consequently of all times to propose the continuance of so expensive an undertaking, how important soever in its results, this was the least propitious; but, from whatever causes, the project now appeared to want sufficient patronage, the appropriation for defraying the future expenses was withheld, and the operation ceased; it, indeed, it might properly be said to have been begun, nor has it since been renewed.

It may be observed, that, at the time when this object was first proposed, and so ardently patronised by the great man who then presided over the United States; the knowledge of its usefulness was limited; and, during the preparations which were making for its commencement, little attention was given to explain the nature and importance of it: in the time of war, and in the disturbed state of affairs which followed, it could not have been otherwise expected, this want of proper information might have been a leading cause of the failure of the design.

It may also be observed, that, when this survey was first proposed, the requisite science was rarely to be found under the immediate command of the government; the Military Academy at West Point was not *then*, what it has since become. The corps of Topographical Engineers was not even formed, nor was the Engineer Department organized: recourse to other means was therefore indispensable to the prosecution of such an undertaking; had it been otherwise, and had the national institutions been as they *now* are, it is manifest that a different process would have been adopted, because the necessary qualifications and all other means are now within the immediate command of the government.

Under these circumstances, should a survey of the sea-coast be resumed, a method, similar to the second, recommended by Mr. Hassler, might be pursued, being less subject to those inconveniences and delays than the first, and, at the same time, sufficiently correct in its results for the purpose required. By determining the latitude and longitude, &c., of the important places on the sea-board, and of certain points on the contemplated road from Washington to New Orleans, an opportunity would be afforded of verifying both those surveys, by a comparison of each with the other, and by using smaller

appropriate instruments for the details of the survey of the harbors, bays, and rivers, valuable materials for an accurate map of that portion of the country, as well as for a chart of the sea-coast, would thereby be furnished, and by running a true meridian line from some one of the given points on the coast to the lakes, and there determining other latitudes and longitudes as well as on its course, the connexion for all geographical purposes would then be permanently established.

The great changes and improvements which have taken place in the national institutions of the United States, since the first projection of this survey, will justify the proposition, that, should the work be resumed, the execution of it may, as well for economy as to ensure its success, be entrusted to the Topographical Engineers, with the co-operation of the Navy; as to these departments, it appears more properly to belong, at the same time that they are particularly interested in the results. An accurate account and delineation of the bars, shoals, soundings, &c., without the coast, in a nautical view, appertain to the latter, the trigonometrical and topographical portions, to the former, and the astronomical observations for latitude and longitude, and other general matters to both. The number of engineers should be such as to admit of subdivision for the purpose of topographical surveys on the shore, where any such might be considered important, without interfering either with the observations, the nautical survey, or the necessary attentions to minor triangulation, meteorological observations, &c. To the command, should be added, persons skilled in other branches of science important to it, in order that the report might be, in all respects, as perfect as possible, and exhibit also the geology and natural history of the different sections of the country. This method, by the subdivision of talent and attentions, would admit of despatch, and, if required, the work might be continued during the whole year; to the South in winter, and North in the summer season. The annual expense would be comparatively small, and should a great triangulation of any particular parts be hereafter required, with large instruments, it could then, with advantage, be undertaken, as all the prominent points would be determined, and,

therefore, no loss of time or expense would, by this method, be sustained.

Were this survey to be undertaken under a commission, or independently of officers of the army and navy, a large increase of expense would evidently be incurred, and less assurance of the perfect performance of it had, than in almost any other civil contract, where the requirements are more definite than those which this work admits of. In this case, there would be no concentration of command, or obligation to duty, other than that arising from personal motives; when the service led to places prejudicial to health, or otherwise inconvenient, disagreeable, or hazardous, obedience might, and probably would be refused, to the orders of the superior, who (be his qualifications for the work, and his ardor in the prosecution of it, what they may,) is, nevertheless, dependent on the co-operation of others in subordinate stations, who have not the same impression of its importance, nor the attachment that officers have, either to the government, or for themselves, in such matters; thus, the project would be subject to disappointment in its progress, and uncertainty in the result; and, at best, no part of the survey could be adapted to military purposes, and, therefore, *in this respect*, it would be incomplete.

No nation has exerted its energies in the pursuit of geographical research more, or with greater success, than the British: the names of Anson, Cook, Des Barres, Gauld, and many others, of former times, and of Le Roy, Mudge, Parry, Sabine, Clapperton, &c. &c. of latter, will ever be recollected, for their exertions, and the ability with which their explorations and surveys were directed, the latter of which, at no future period, can be surpassed. After having made accurate surveys of their own coast and harbors, their attentions were directed to the like pursuits in other parts of the world, which has continued during the boisterous scenes of war, as well as in the calmness of peace, to the present time; and they are now engaged on the same object, regardless of expense, of difficulties, or danger. To that nation, and to the skill and science of its naval and military officers, to whom the direction of these explorations and surveys are exclusively entrusted, and the United States, and the nations of Europe, indebted for a greater part of the charts now in use,

as well as for geographical information, of the most valuable kind. The employment of officers on this service does not, however, preclude the association of others skilled in sciences connected with it; on the contrary, they are generally employed; but the command and management is confided to the officers, and they *only* are responsible, at the same time, that due merit is allowed to each individual concerned in it, for their respective investigations and services.

There is, perhaps, but one instance on record, of a contrary system being pursued by that government, and which occurred in the year 1698, when the celebrated philosopher and mathematician, Doctor Halley, had charge of the expedition, with orders, by observation, to seek the discovery of the rule of variation, and to survey or explore his Majesty's possessions in North America; a brevet commission of Lieutenant was procured for him from King William, and Lieutenant Clark, of the Navy, served under him. But with all this precaution, the crew, denying the legality of his authority, mutinied, and he was obliged to return in 1699, without accomplishing the object of his mission; Clark was cashiered, but that was poor recompense for the failure of the expedition; it served, however, as a precedent in after times, for the Royal Society of London, in the year 1769, petitioned the King to fit out an expedition to the Friendly Islands for observing the transit of Venus over the Sun's disk, and for other purposes; Alexander Dalrymple, Esq. an eminent member of that body, was recommended to the duty: In order to obtain the proper command of the vessel, he demanded a brevet commission of Captain, in the same manner as had been formerly granted to Doctor Halley, which Sir Edward Hawke refused to sign, declaring that he would not, on any account, consent to entrust one of his Majesty's ships to a person not regularly bred to the service; on this occasion it was, that the celebrated Captain Cook was promoted to the rank of Lieutenant, in May, 1768, and took command of the *Endeavour*, which had been appointed to that service.

The same system has since been uniformly pursued, under it are those now engaged in pressing the explorations into the interior of Africa, and to the Polar regions, whether by land or water: be the ob-

ject, an extension of commerce, or the advancement of science, in every instance officers are employed.

With peculiar propriety does the same system apply to similar undertakings in the United States, and it offers the only means of acquiring practical information in the various branches of science connected with the duties of an Engineer, and which, in order to attain excellence, requires subdivision in the pursuit; but principally because the departure from a method universally adopted by other nations, would argue a want of confidence in the talents of the officers, as well as in its national institutions, which does not exist, and thus tend to depress the spirit of enterprise so essential to the prosperity of Military and Nautical Science.

In the large armies of Europe, this subdivision is made by separate corps, and embraces a certain portion of science to which the attention is principally, if not conclusively, devoted. To this arrangement may be attributed, in some measure, the eminence to which the engineers of France have arisen, and become so important in civil and military service to their government, and in their example to the world. The institutions of the United States do not admit of such a subdivision by corps; but yet the same principle is attended to, and aimed at, by the topographical engineers in their surveys reconnoissances, and by continuing this practice, a suitable classification may, at some future time, be advantageously made.

Connected with the survey of the sea-coast, are two other important and indispensable objects; one, the establishment by law, of a Board of Longitude, and the other the construction of a national observatory.

The former is necessary to receive and regulate all matters relating to nautical and geographical science, to encourage improvements in it that may be proposed, and to authenticate such publications as may, from time to time, be considered useful.

A Board of Longitude was first established in England, in the year 1711, for rewarding any successful endeavors to keep the longitude at sea. It was not until 1767, that this Board first published a Nautical Almanac, which has been continued annually since, by the advice, and under the direction of the Astronomer Royal at Greenwich; the importance

of this work is too well known to need animadversion. Under the auspices of this Board, too, besides giving encouragement to the authors of many useful tables and other works, which would otherwise be lost, time-keepers have been brought to a wonderful degree of perfection, which would not, without this aid, have been attempted.

The connexion between this Board and an Observatory is obvious, and the duties of them inseparable, the one to furnish the necessary observations and tables, the other to employ competent persons to make the necessary calculations, and to publish authentic copies of them for general use; all others than those appointed by the Board are prohibited by the laws of the realm from editing this, or a similar work.

A national Observatory is required, as well for the purpose that has been mentioned, as to ascertain, by astronomical observation, the geographical position of places; but a great object in this establishment here would be, by numerous observations at the seat of government of the United States, to investigate and fix, as far as it may be possible to do so, the doctrine of *refraction*.

This subject, particularly as it refers to the heavenly bodies when viewed from the earth, has engaged the anxious research of European astronomers and men of science, for a great length of time, without producing satisfactory results; in the inquiry is involved so many and such various properties, indefinite in their nature and effects, that no positive or distinct conclusion has yet been drawn from all the endeavors to investigate them. It has been theoretically explained and subdivided into different terms, such as celestial and terrestrial refraction, &c.; and by repeated observations of the effects produced by weather, in various temperatures of heat and cold, clear and cloudy, attempts have been made to establish some rule or principle by which this phenomenon may be satisfactorily accounted for and fixed: but there are properties in nature beyond the reach of mathematical reasoning, and require only the attentive and constant observation of *fcts*, which, when attained and acknowledged as truth, are yet inapplicable to any rules or theorems, resting solely and independently upon the principle that the result

is such. Of this class, may, perhaps, be regarded *refraction*, for no settled maxims respecting it have yet been decisively explained.

For some time past, very many observations, with reference to this subject, have been made at different observatories in Europe, particularly at those of Greenwich and Paris, but without the desired effect. Depending as it may be supposed to be, on the peculiar state or qualities of the atmosphere, and as those qualities differ, not only in the difference of latitude and longitude, but also, at the same places at different times, when the medium is more or less dense, occasioning a greater or less inflection of the rays of light in passing through it; if there be no other causes more definite, and approaching nearer to any fixed principle, the geocentric distances of those observatories are not sufficiently great to discover it by corresponding observations made there, and particularly, as the same atmosphere, by this proximity of position, may be supposed to be common to both at the time of making the observations, and therefore the results, on this account also, would be the same.

But were an observatory fixed *here*, the case would be materially different in every respect, and by corresponding observations made at Washington, so much nearer the Equator, and with the difference of nearly 77 degrees of longitude, results might and probably would be produced of a most interesting kind, to the advancement of this branch of science; for, besides the geocentric difference of position, that of the surrounding atmosphere here is still greater, not occasionally so, but at most times, and particularly at those seasons of the year most favorable for observation. At such times, there are comparatively few days or nights, on which the heavenly bodies may not be seen to the greatest advantage, through a medium more free from exhalation and vapor, or other impurities, that may affect the atmosphere at the places which have been mentioned.

Whatever other advantages may arise from the establishment of a National Observatory at Washington, this is, of itself, sufficient to justify the measure; it is due to the national character, as well as to those nations who, by their exertions, have hitherto afforded the means of directing the wayward

course of our mariners on the ocean, and furnished the land-marks on our shores, that some attempt be made, by us, to improve this essential branch of science.

Independently, however, of this consideration, it is evident that an observatory is essential to the proper success of any undertaking of this kind in the United States. Upon it, the survey of the sea-coast will greatly depend, as will that of the national road from Washington to New Orleans, and the proposed meridian to connect the Western lakes with those of the Atlantic. To all these, an observatory, as a fixed point to which they must refer, is indispensably necessary. Besides, it is the only means whereby practical knowledge can be attained by the officers of the army and navy, in this useful branch of science. To afford this opportunity, is an object of great importance; without it, the talents of the nation, in this respect, never can be developed or known, but remain forever dependent upon the investigations and intelligence of others, without the means, even of verifying or correcting the differences arising from the position of this country.

That there exists here native talent abundantly sufficient for the management of such an institution, is not to be doubted; but all energies are cramped and rendered useless for want of a theatre on which to exercise and improve them. The necessary instruments are now in the possession of government, and it needs but the further extension of its fostering hand, in the construction of a suitable building, to afford ample facility to the improvement of science, and the promotion of those researches which will hereafter, in their results, place the United States, in this respect also, on a level with the enlightened nations of Europe.

That this survey must be undertaken at some time, is certain. Under what circumstances can it be more favorably done, than at present? In the full enjoyment of the blessings of peace;—when the national institutions are successfully progressing;—when a desire for internal improvement of the country so generally prevails, and science in the prosecution of it, is sought for and cherished! Surely, at no future time can it be supposed, that so many circumstances will concur to favor the accomplishment of this object, so

important in its relations, and the more so as they may be considered the first fixed principles on which the correctness and permanency of all geographical improvement must depend.

Washington, December 9, 1826.

To the Editor of the National Journal, Washington.

Having seen in your paper of the 1st January, a discourse of Col. Roberdeau, read before the Columbian Institute, entitled "Observations on the Survey of the Coast of the United States," I feel it a duty to my character, and even to the nation, to request you to insert the following remarks in your paper, at as early a period as possible, in order that they may meet the same eyes as the paper you have published.

Col. R. has mentioned me, in the paper to which I allude, as having done something in the survey of the coast. But although he has been now for many years the keeper of all the instruments, books, and manuscript documents which were delivered by me to the officers appointed by the Government to that purpose, and among the rest to Col. R. himself, his statements are altogether erroneous; and I must correct them from my documents, and my intimate knowledge of the facts and the subject.

Col. R. states—that "*The appropriation for defraying the farther expenses was withheld, and the operation ceased, if indeed it might be properly said to have been begun.*"

It is, in the first place, incorrect to say that *the appropriation was withheld*, as will be seen from the following simple statement of facts.

My agency in the survey of the coast closed in consequence of an act, which was hurried through Congress without debate or committee, (in the House of Representatives,) under date of the 14th April, 1819, which enacted, *That so much of the Law relating to the survey of the coast shall be repealed as followed to employ others but naval and military officers.*

The original Law did not even mention naval or military officers. Only I had in my plans proposed the use of them, as advantageous, by forming some of them in a school of practice to greater usefulness, and with a view to economy, considering them otherwise paid. The idea had not previously existed here of any part of this work being adapted to them. For

this liberal anxiety of mine, to take the greatest advantage of this work for the country in general, and to be serviceable to the army or navy, and to Col. Roberdeau's corps in particular; I am now paid by his general argument: that none but military men are fitted for such a work !——!

On the 28th of April, 1818, date of the expiration of the appropriation for the coast survey, there was a large balance of unexpended appropriation remaining. By a rule in the transaction of public business in Washington, the departments, except the Treasury department, can protract an appropriation, so as to be two years longer disposable, by having the balance paid over to the Treasurer.

That the public might not be deprived of the result of my labours, notwithstanding my interest in the work, had thus been cut off in the most unjust and unhandsome manner; and by agreement with the Secretary at War, Mr. Calhoun, I announced myself to Mr. Crawford, this transfer of the funds to the use of the war department; to enable it to continue the work, as the law supposed, and it was done about one o'clock that day.

Immediately after, I delivered also to the Engineer department, my manuscript journals, and results of calculations; and soon after, the instruments required for the work, the books, &c. (see the duplicates of receipts) the spring was at hand, my signals were all standing on the respective stations. If the department had had under its orders *only one man capable of* continuing any part of the survey, it might have been done instantly, as indeed the repealing act required.

Nothing, however, has been done up to this day, notwithstanding the anxiety frequently expressed for the continuation of the work. I am therefore warranted in saying, that no man of the requisite attainments does exist in either of the Engineer corps; and I may say this without affecting their character as soldiers, and otherwise useful men, because, *this branch of knowledge is actually, wither their business, nor within their reach.*

Since my papers on the coast survey have been published in the philosophical transactions of Philadelphia; a new light appears to have arisen to them.

though my journals, results of calculations, &c. which form for them the truly essential part for the carrying on of the work, and which every man competent to replace me, could not fail to understand, have been nearly nine years in their hands. But with all this aid, neither is my plan understood by the writer of the observations, nor does his proposition of another contain ideas that could be carried into effect, or shew the slightest acquaintance with the subject, as every man of science in this branch will all at once see, so that I need not even enter into particulars, it administers the positive proof; that even with all my papers in hand, they are as little able to make a rational step in the work, as I have seen others trying to determine the latitude with the encyclopedia in hand. all the native talents notwithstanding.

The hopes grounded upon the capability of the cadets of Westpoint for this duty, are equally unfounded. For the correctness of this position, I appeal to the Engineer Corps, and the government of the Academy themselves. The instruction of this Academy, though good, is but elementary and general; the time spent in it is too short to embrace with their other essentially military studies, this more extended and complicated one. A wide chasm remains between such a work and their studies: it does, in short, not belong to them. Another field of great detailed extent, requires all their time and exertions; because it is the essential part of their duty. Attempting to do more, or expect more than is possible, is doing or obtaining nothing that is right.

In every fully organized system of education of men for public utility in these branches, separate establishments for the different branches, superior to the elementary ones, are found necessary; and the military part is, and must be, separated from the civil part; each having its peculiar principles and sciences, must also have its separate establishments,—men, organization, &c.

Whether (in the second place) *“the survey might indeed be said to have been begun”*—Any of our military gentlemen would have apprized the public at the sound of drum and trumpet, if he had, as I have done, furnished all the plans in detail, and every idea that led in the work; superintended the construction

of the instruments on my own new principles, (1) which, after fifteen years improvements in the arts, are still considered as master-pieces: proposed and executed methods of observation and calculation on new principles, mathematically demonstrated, furnished the whole organization of the details of a work of such extent, importance, and peculiar difficulties, in a manner as I will let these gentlemen read themselves, in the scientific journals of *Europe*. In truth, it is customary in civilized Europe to allow some merit to such works, because they are considered the most essential, and in an intellectual point of view, the most valuable part of the work.

But besides this, I delivered at the time when my operations were suspended, and I condemned, without a hearing, (nor even a chance for it) to the use of the continuance of the work, and in perfectly clear order in my journals and results, ninety fully executed triangles and thirty more partly done which are leading to the further works, in all therefore the data or elements of 124 triangles, (2) grounded upon a base and a verification base, measured and verified by a coincidence more than sufficient for the topographical purpose within the limits they were to serve for the time, though the measurement with the peculiar means of accuracy, invented by myself, for the use of the great extension of the main triangulation, was necessarily postponed for the next intended campaign. Latitude and azimuth determinations were sufficiently on hand, to assign to this work its proper place and direction on the spheroid of the earth, &c. The state of forwardness was such, that I had already announced to Mr. Crawford, that with the beginning of spring, 1818, two brigades of officers, the one naval, the other topographical, might be set to work to fill up the details of that part of the survey; for which I would present the proper plans of operation. It remains, therefore, with those who question whether the work was begun, to show the public how it happened that this was not done with all the means in hand, and the law in favor. (3)

1 See Brewster's and Rees' Encyclopedia (circle).

2 Receipt of 28th April, 1818.

3 My letter to the Treasury Department, of 7th July, and 8th and 18th of December, 1817; 3d, 6th, 9th April, 1818. To the War Department of 27th April, 1818, and to Mr. Gallatin, 28th April, 1818.

That the plan of operation which produces the most good work within a given time, is certainly the cheapest, I hope will not need to be discussed; and as a testimony of the faithfulness of my word, given in my letter of the 5th January, 1818, "to conduct it in a manner *permanently useful and honorable*," I will take the liberty to insert a letter from the very hand that drew up the Declaration of Independence, the head and character who conceived it, and supported it for half a century, whose head, heart, and judgment, in both these branches of science, may be permitted to overbalance the aspersions with which I am honored from other sides.

(COPY.)

Monticello, Dec. 3, 1825.

Dear Sir—Your favour of Nov. 24, is just now received, with the papers on the survey of the coast, which you have been so kind as to send me—for these be pleased to accept my very particular thanks. In the last volume of the Transactions of the A. Phil. Society, I had especially remarked these papers, and the processes so peculiarly accurate and ingenious, by which you have proposed to execute the survey of the coast. I regret much that it was not carried into execution, as, independently of the permanent security it would have procured for the navigation of our coast, it would have been an honorable monument of the state of science at this early period of our history. Attentive, in every thing, to what I can find in it, which may be useful to our University, (now the only object and occupation of my life) I singled out your plan of an observatory, which, for its simplicity, solidity, and every aptitude for its purposes, and for its economy, presented at once what I had, for some time, thought of requesting some kind friend in Europe to procure for me. I therefore deposited the volume in the library of the university, with a note on a blank leaf at the beginning, specially referring to your plan, as suiting us exactly, whenever our institution should be sufficiently advanced to call for an observatory; we have secured a site of peculiar advantage for one in future.

There is a material part in your description, which

I did not understand, and I was intending (with a request of your approbation of our adopting your plan) to have asked of you some more particular explanation of that part. Your letter furnishes the occasion of doing it now. The passage is pa. 148, beginning with the words, "the roof over the transit, &c.," to the words, "cannot be described here," pa. 149.—I do not understand this construction at all, and if you can aid me in it, you will oblige me.

Permit me, at the same time, to suggest to you a construction of flat roofs, different from yours. In fig. 4, you have two strata of joists, the one 5 or 6 feet above the other. I do not see the use you propose to make of the space between them. In the house in which I live, and its offices, I have flat roofs, of a different construction; they consist of rooflets, 30 inches wide, with gutters between them; there are 2 strata of joists, the one about 9 inches higher than the other, arranged thus:—



A single length of shingles reaches from the top of the upper joists to half way down the gutter which is made in the lower joists, overlapping just enough to deliver the water safely into the gutter. These gutter joists, as well as those constituting the ridges of the rooflet, have a descent of 6 inches from their middle point to each end, which over-jets the wall so as to deliver its water clearly over it. A floor is laid over the whole to walk on, the water first falling on that, and passing through its cracks, drops into the gutters. I have had upwards of 20 years' experience of these roofs in this house, also in one I built at another residence, and more than half our buildings at the University are flat, and so covered. They never have leaked, cost less than a rafter roof, as needing no rafters, and admit repairs more easily than any others. I think it the best possible roof for an observatory.

With every wish for your welfare and happiness, accept the assurance of my great esteem and respect.

(Signed)

TH. JEFFERSON.

This letter may also answer Col. R.'s Treatise on a National Observatory, &c. The information asked for, by Mr. Jefferson, was given in my papers; this part was purposely only hinted at for brevity's sake: I stated also why a flat roof was not proper for an observatory.

I have now to notice that part of the observations, which urges the employ of none but military and naval officers, on the ground that *they would never obey civil directions*. I am reluctant to believe that this be a fair statement of the views and *character of our republican military*. It is a principle of the constitution, that the military *shall be in subordination to the civil power*. The President of the United States, who can happily rarely obtain that elevation by mere military character, is the constitutional commander of the army, and can delegate this power, in the whole or in parts, as he pleases; instances of it are too abundant, and the subject not to be debated here. No officer fit for the occupation, would think of such a cavil, in a work as the Coast Survey *was*; nor is there, in the obedience to scientific directions, any thing that could derogate to the highest military character.

The instances which have been adduced in support of this position, are very unfortunate. The errors, both in the principles and in the results, of the British survey, have been, for many years, subjects of papers in their own philosophical transactions, (see the papers of Mr. Rodrigues D'Tiark's, &c.,) and elsewhere. Since the death of General Roy, the character of the work has changed; and the official inquiries made by order of the House of Commons, in 1810, has, by the report (which I brought from London, and which lies in the War Department, though it is my property,) shown, what I think would, in this country, dispense a military chief of all further troubles in such a work. In all other countries where such works have been well executed, the schemes originated, and the direction was in the hands of civil men of science, who often had officers under their command. In France, Cassini, Delambre, and others. In Denmark, the astronomer Bugge. In the north of Germany, Zack, Gauss, &c. &c. When I accompanied my friend, Professor Bohnenberger, of

Tubingen, in his triangulation of the map for Swabia, under the patronage of the Archduke Charles of Austria, in order to join his triangulation to mine in Switzerland, he had under his orders an Austrian nobleman, a Captain of Engineers, with other military assistance, who was far from finding a degradation in obeying even a civilian man of science. I might even prostrate, by British examples, those unsuccessful ones, which are quoted to support the *unconstitutional assertion*. But so much is true: that blind, and even ignorant obedience and strict discipline, may suffice for common military purposes, while in a scientific work only, actual zeal and scientific interest for the object in view, decide the fitness of the man; *ideas of private interest, false honor and pretensions, are in their nature foreign and directly inimical to such a work, and do not even occur to the man fit for it.* (4.)

I owe here an account of the origin and my connexions and agency in the survey of the coast. I arrived in this country, in October, 1805, having relinquished my public stations in my native country, Switzerland, foreseeing the turn of political events, which have since come to pass, and from a predilection for a rural life, with completely different views, and means quite sufficient for them, but which I have still to claim. Having landed in Philadelphia, the late Professor Patterson, Mr. Garnet, of New Brunswick, and several other gentlemen, on seeing the books, mathematical instruments, &c., I had brought with me for my private enjoyment, were so kind as to show me some attentions. I had occasion to show them, in conversation, by the scientific publications of Europe, that I had been engaged in an extensive survey in Switzerland, which was interrupted by the revolution. Professor Patterson sent to President Jefferson an account of my former life, which I furnished at his request; and Mr. Clay, the representative to Congress, from Philadelphia, before setting off for Congress, in 1806, asked me, if I should be willing to undertake the survey of the coast, to which I assented.

4. For my own experience in this particular, see my letter to the Treasury Department of 6th August, 7th September, 8th December, 1817; of 2d February, 18th March, 9th April, 1818; and to the War Department of 14th February, 1819.

The law authorising it passed in that session, (10th February, 1807.) I received one of the twelve circulars, addressed to scientific persons, requiring plans for carrying it into effect. Thirteen plans were received by the Treasury Department. (5) By President Jefferson's directions, a commission sat upon them at Professor Patterson's, in Philadelphia, formed of the other gentlemen who had given in plans.—In rejection of their own, they recommended mine to the President, and Professor Patterson informed me of this, by direction from President Jefferson, under date of 21st July, 1807, (to the Military Academy at West Point, where I had been appointed Professor in the interval,) adding, that the execution was for the time suspended on account of the aspect of politics; but requesting me to propose the necessary instruments and other details, which I did, and interchanged several letters.

My mission to London for the instruments did not take place until August, 1811, (6) when I resigned the certain and respectable position of Professor of Mathematics and Natural Philosophy of Union College in Schenectady, to (as I thought myself honorably bound) embark in the execution of my plans for a work, in which the disagreements and the pecuniary losses have exceeded, by far, my compensations.

Shortly after my arrival in London, the war broke out; I was there four years, under the disagreeable situation of an alien enemy, and by the neglect of the Treasury Department, left two years without compensation—my drafts for the first of them having been protested, and the plea *that the endorser bought them with the government money*, being greatly indebted to it. He and I returning to this country nearly at the same time, I having faced all my expenses by my private means, (7) the drafts were paid to him cash—my note for indemnity left in his hands, he began a lawsuit against me for it, though I had actually still to claim a balance upon him, the Treasu-

5 Circular of 25th March, my answer, *Philadelphia*, 2d April, 1807.

6 My instruction is of 23d August; my passport from the Department of State, of 19th August; and from the British Envoy Extraordinary, Augustus John Foster, of 25th August; my letter from on board the ship *Armata* at sea, 30th August; from London, 17th October, all 1811. 7 Accts. of 20th November, 1815; of July, 1816; and my letter of 11th June, 1816.

ry Department left me unsupported, to shift for myself, notwithstanding the previous promise of Mr. Dallas. (8) It was not until August, 1816, that the *contract* with me, to undertake the execution of the work was concluded, (which, for good reasons, I had preferred to an office-like appointment.) (9) I entered upon the work immediately, by the absolutely necessary preliminary steps of reconnoitering; and again at my charge for all expenses, &c., as the funds appropriated to the public part of the expenses, by agreement with Mr. Dallas, were refused by Mr. Crawford, (10) and the same was the case several times afterwards. To relate the other difficulties in my way, would detain me too long—the ample correspondence between the Treasury Department and myself, gives the account of them.

The result in general was, that though several young officers were detailed, and received extra pay, as attached to the work of the survey, no angle was observed, and no calculation made, for actual use, except by myself. My principal assistant was my son, who received no compensation, and an intelligent man, whom I had taken into my house, and paid at my expense.

In this way I pushed on, by forced exertions, and to the loss of my health, (11) to present to persons, totally unacquainted with such works, who always expect more than is possible, a mass of results, which I feel perfectly safe in saying, exceeds what has ever been done in the same space of time in any similar work whatever. The collateral experiments necessary for such a work, are numerous, require time, reflection, care, &c. &c. (12) and the expenses of them were borne by myself. How many other works attend such an undertaking in the beginning, which do not appear in the ultimate results, is sufficiently known to men of science. All that was rewarded by

8 Contract signed by Mr. Dallas, 3d. August, 1816; my letter of 11th June, 1816.

9 Letters of the Treasury Department, of 13th September, 1817; of 13th July, 1816; my letter of 16th October, 1816; of Mesas Barling's to me, London, 28th June, 1815, and others.

10 Letter of the Treasury Department, 30th November, 1816.

11 My letter of 3d April, 1815.

12 My papers in 2 vols. of the Philosophical Transactions of Philadelphia, and the reviews of them, London Quarterly Journal of Science, Revue Encyclopédique, &c. &c.

my being charged, "*that the little progress hitherto made in the work, has caused general dissatisfaction in congress,*" (13) which I thought even ignorance and malevolence united could not dare to prefer, though Col. R. reproduces it in other words, and which I answered instantly. (14) If that had been the case, how could I, at a sudden, unexpected interruption of the work, have presented a full, ordered, systematic mass of work, ready for use, and in good order.

I invite competent men or authority to a full perusal of all the documents. But I must decline being judged by the report of the Treasury Department to Congress, because the documents are *mutilated*; and even the *compensation* of my manifold *pecuniary losses*, in my connexion with the government, *would by no means be an injustice*. In concluding, I feel it my duty to refer to a fact in relation to national civilization and improvements, as shown by the universal history of mankind. The nation that shall exclude from itself the admission and use of foreign talents and knowledge, must always remain behind in the path of civilization, and will appear comparatively barbarous, if not really become so. Sciences, arts, and ideas for improvements, are the common property of all nations—their mutual ties—and cannot be successfully cultivated without free intercourse, exchange, and intermixture.

It is surprising to hear a contrary assertion promulgated in the United States, (as the writer of the "Observations" does, by the over-weight which he claims for his native talents!)—in that country, that ought to be adduced as the most striking instance of the truth of that principle. Every civilized nation of Europe has contributed its share to that happy mixture of knowledge and ideas of improvements, that has caused the character of this country to rise to so high a standing. I do not hesitate to assert, that the continuance of this intermixture is essential to its future progress, and, I may add, vitally important to its existence, as an independent nation.

F. R. HASSLER.

New-York, 8th January, 1827.

13 Letter of the Treasury Department, 6th April, 1818.

14 My letter to the Treasury Department, 9th April, 1818.

COVER MISSING